IN SILICO DOSIMETRY

Faiza Bourhaleb
I-SEE COMPUTING

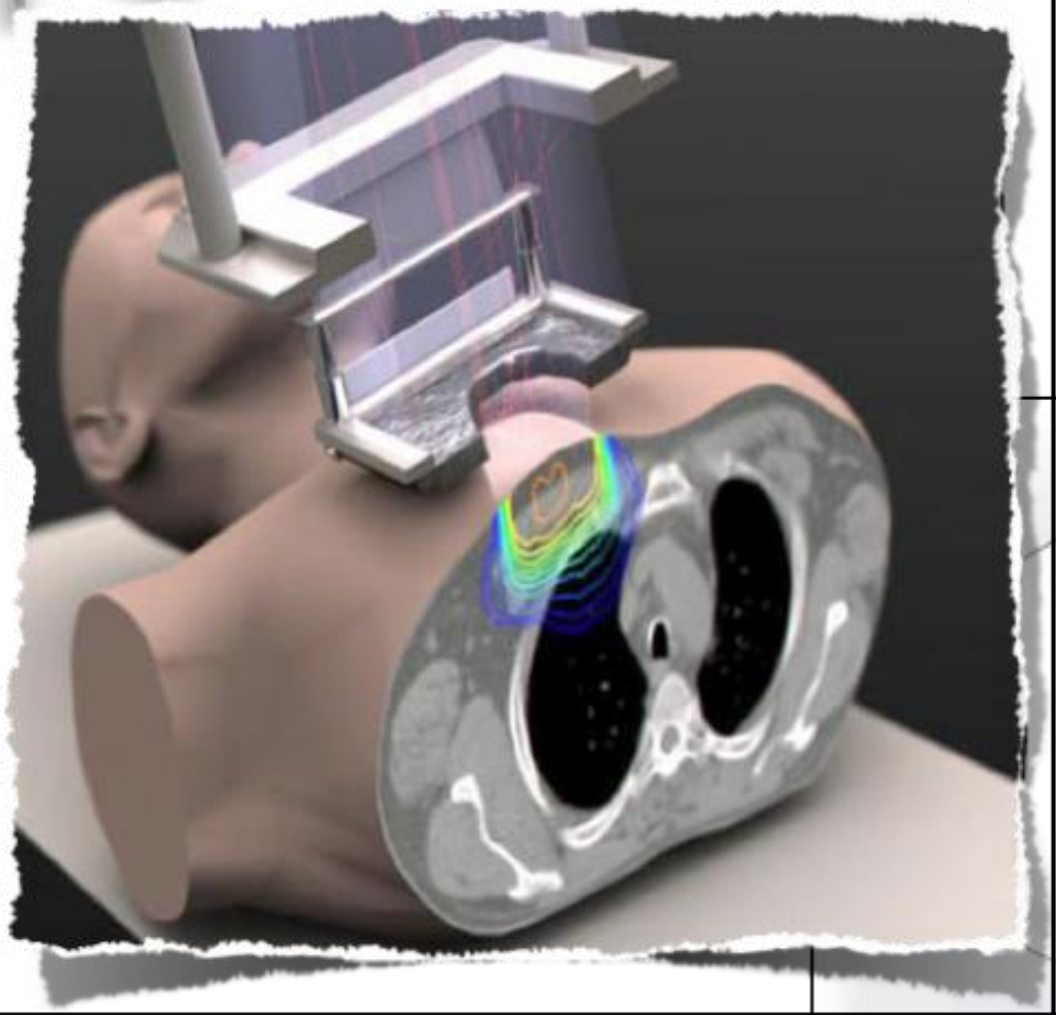
INDEX

- INTRODUCING I-SEE
- APPLICATIONS WITH I-SEE
- I-SEE INTERFACE
- EXAMPLES
- I-SEE CUSTOMIZED PRODUCTS

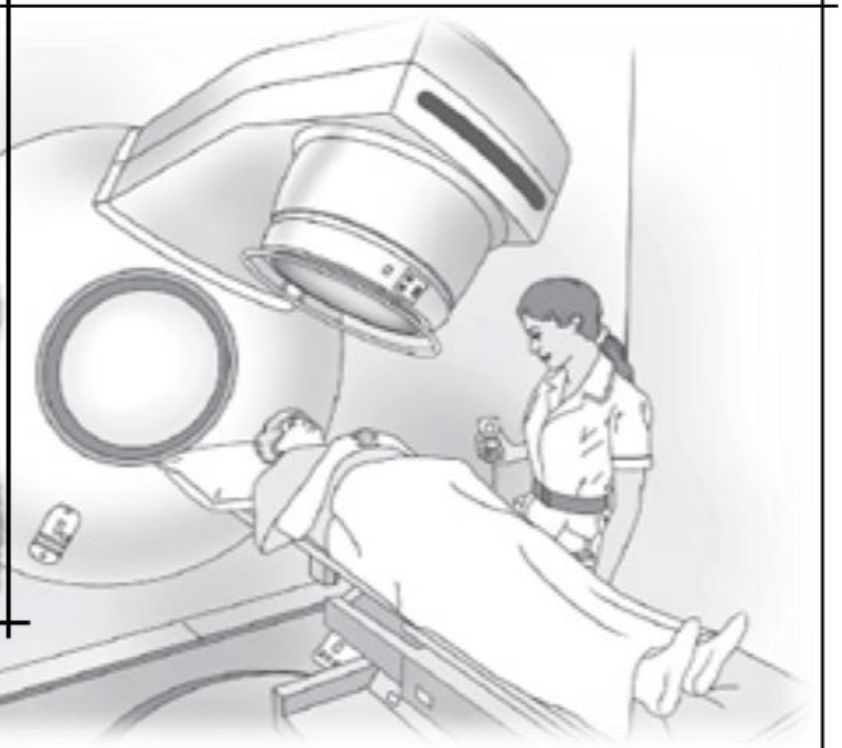
Collaboration

- In the framework of a collaboration between I-SEE and Nucleonica
- Objective: better products and better services
- Radiation therapy field

APPLICATIONS

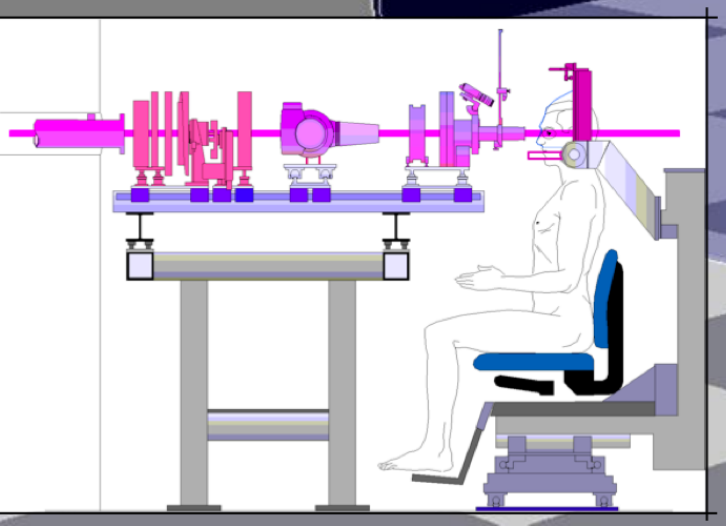


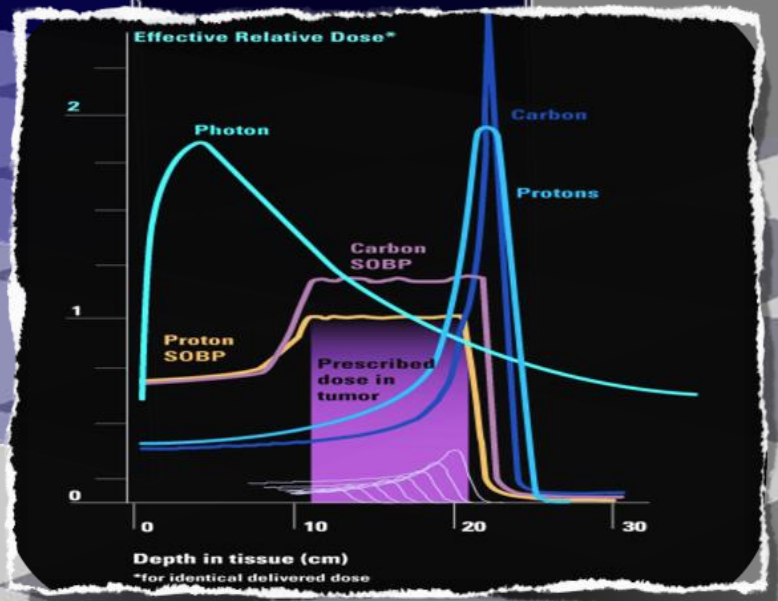
Radiationtherapy



APPLICATIONS

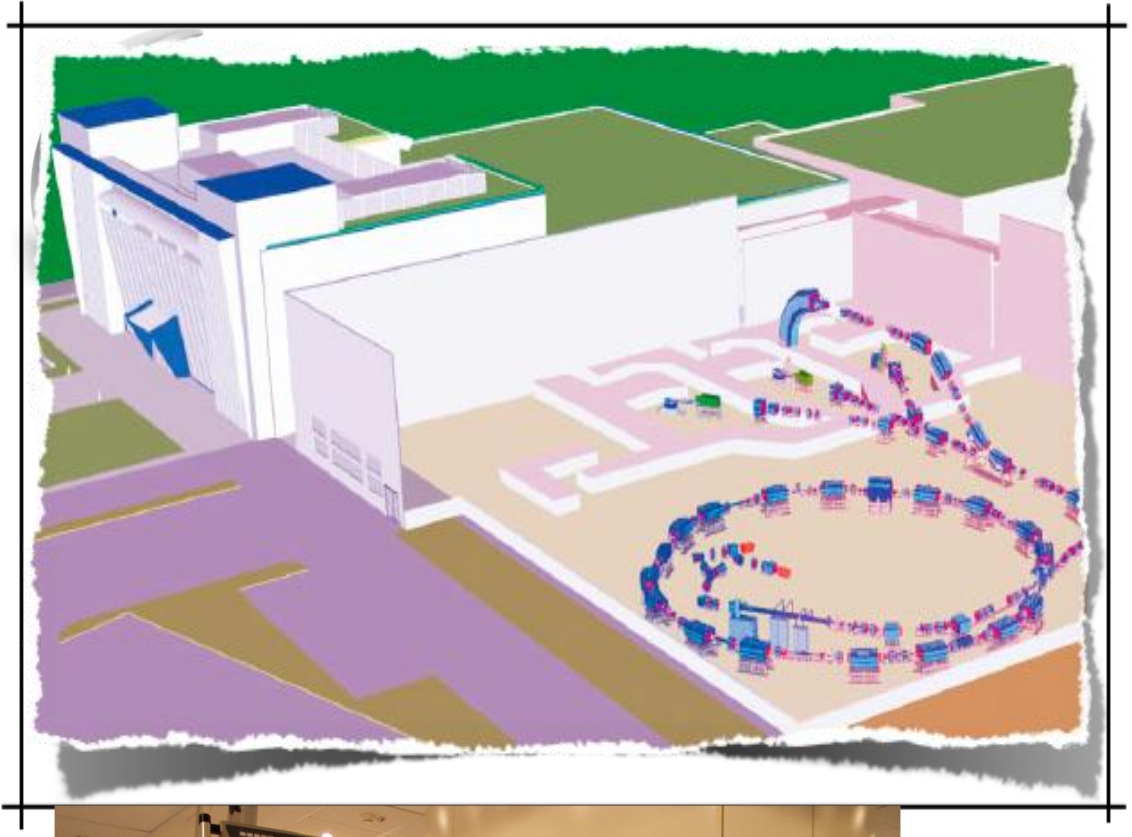
Protontherapy





CNAO

Italian National Center for Hadrontherapy

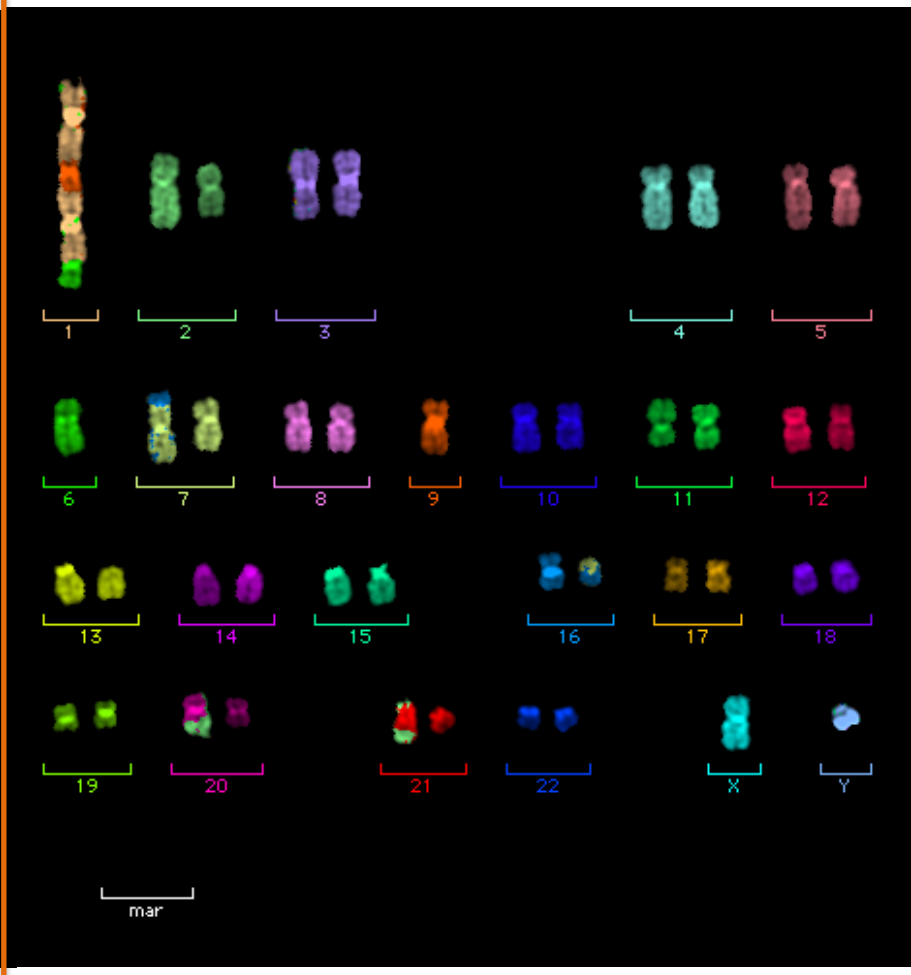


The space radiation and biophysics research

“Special” chromosomal damage induced by low doses of heavy ions

3 Gy γ -rays

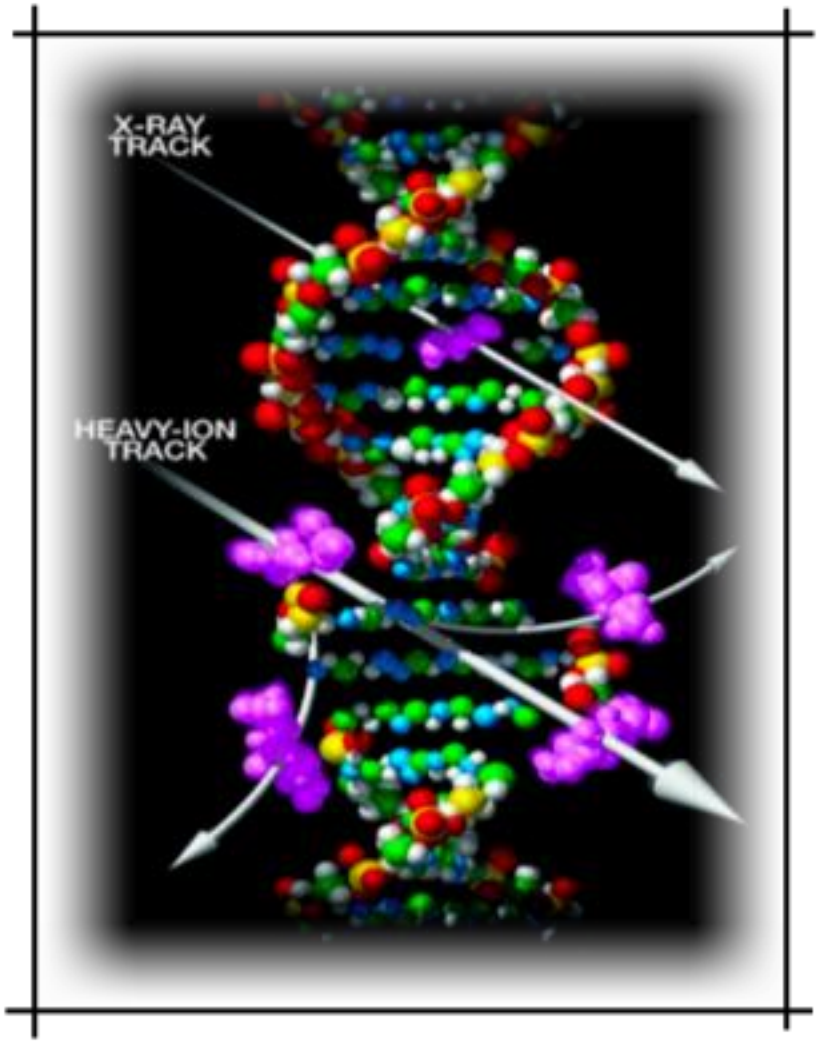
0.3 Gy Fe-ions

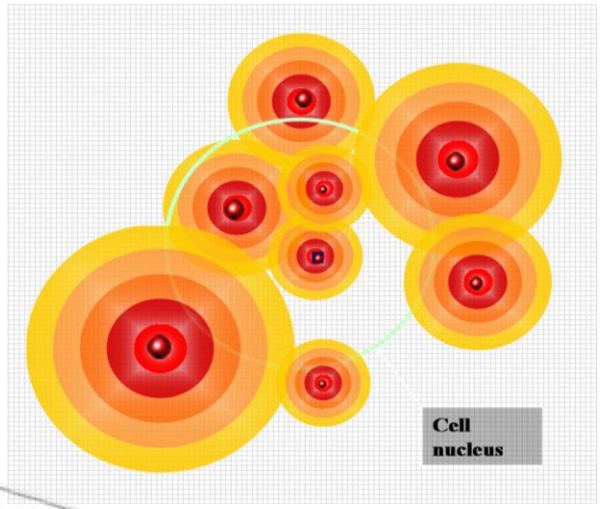


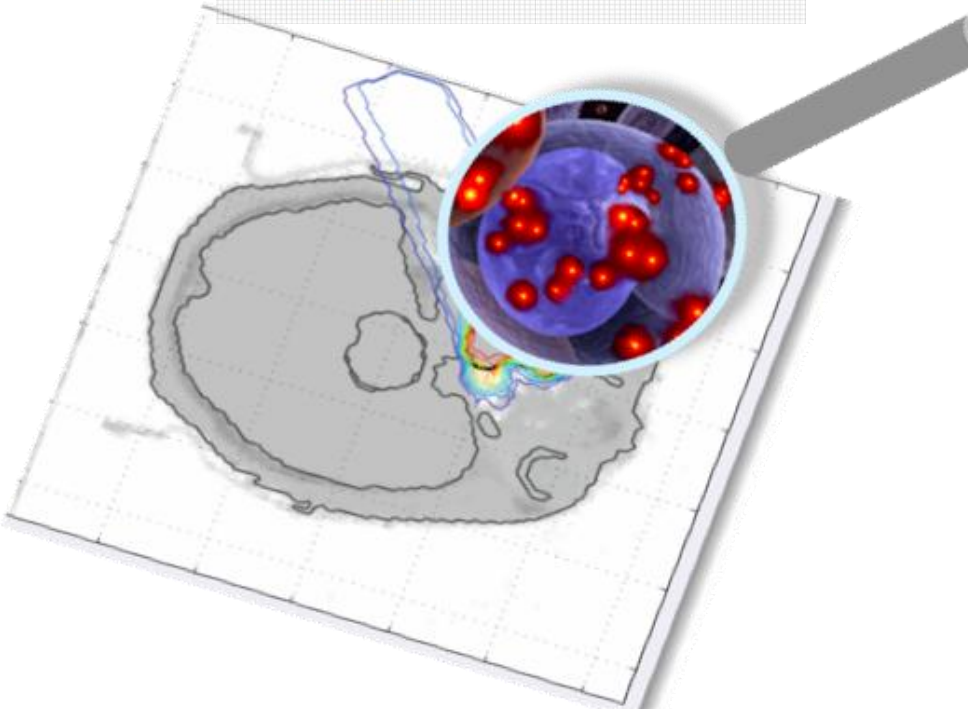
Durante *et al., Radiation Research* 2002

APPLICATIONS

RADIOBIOLOGICAL SIMULATION

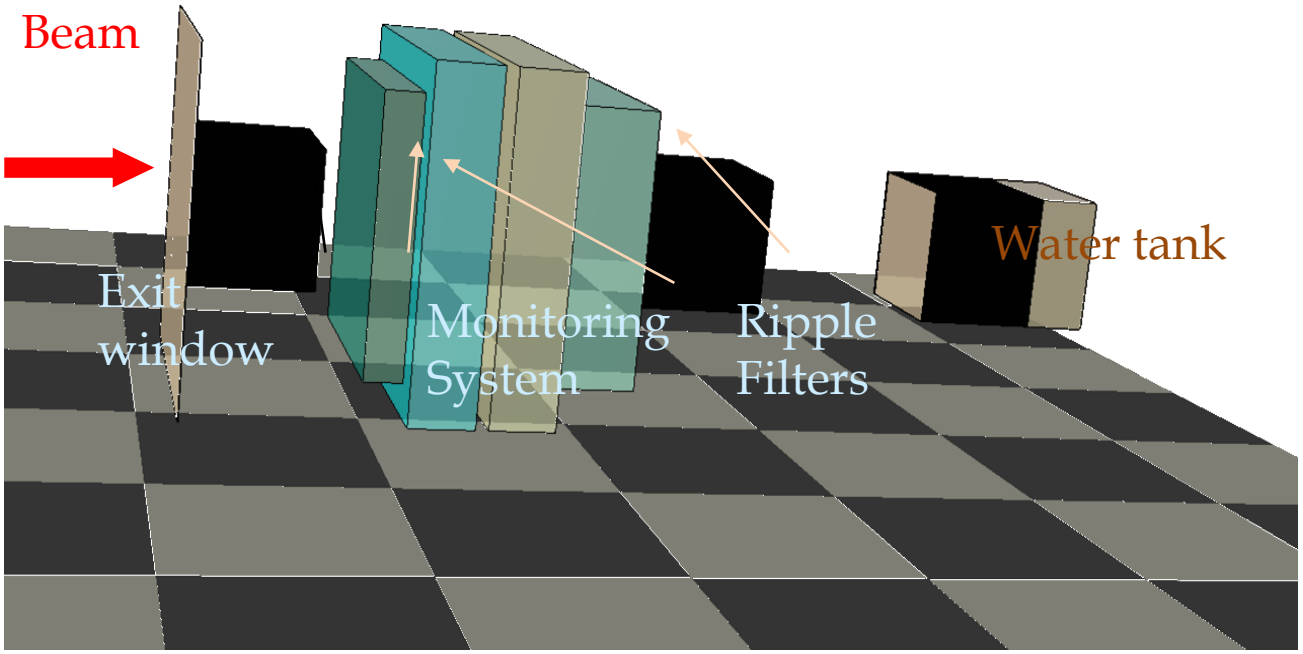


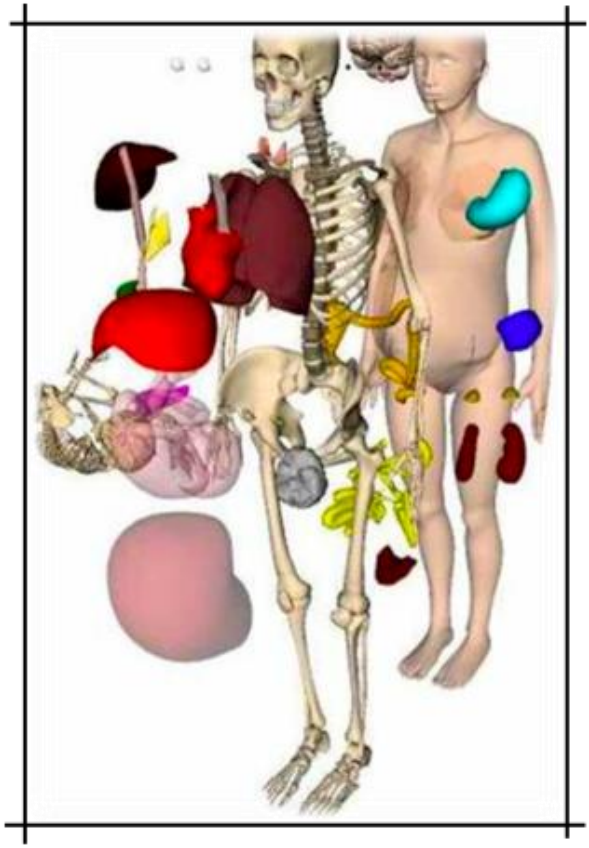




APPLICATIONS
BEAM DELIVERY LINE

Protontherapy
Carbon ion therapy





-> Exit window

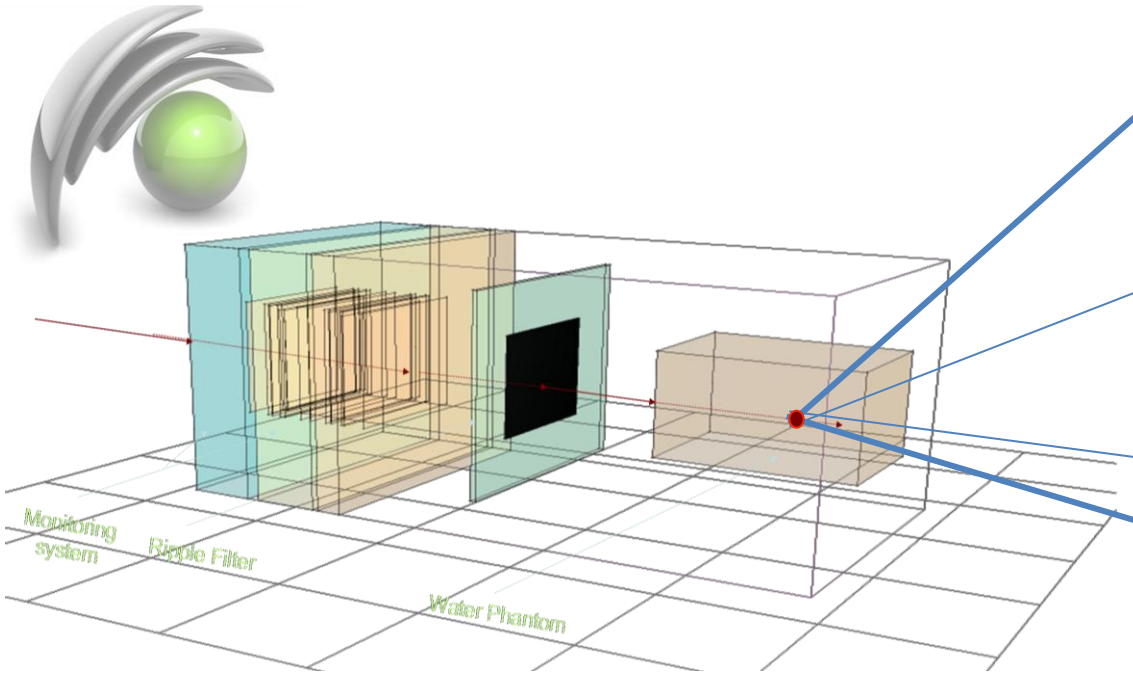
-> Monitoring System

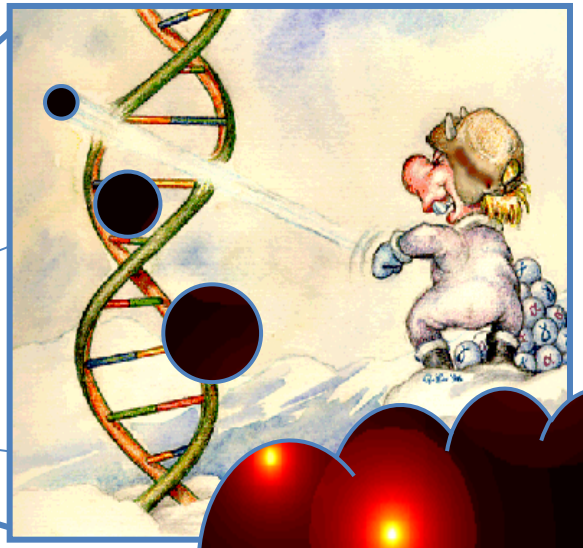
-> Ripple Filters

-> Passive Elements

HUMAN TISSUE

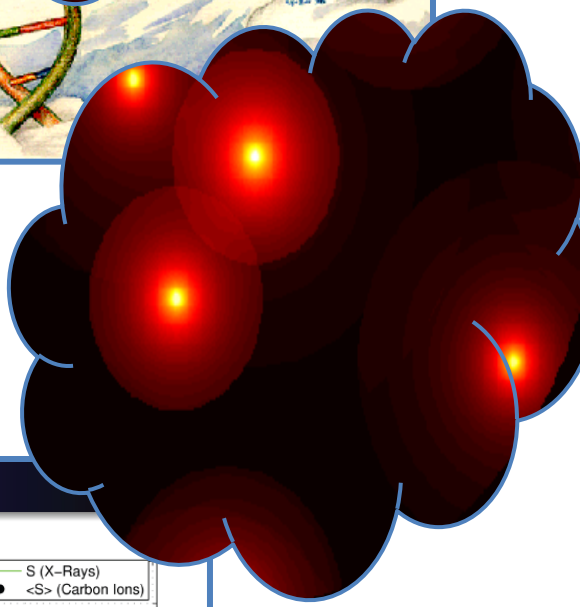
Modelling

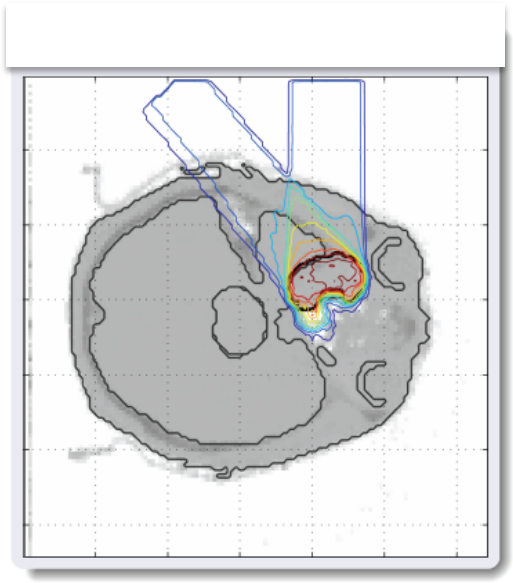


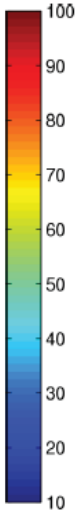


meters

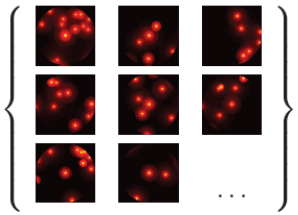
microns



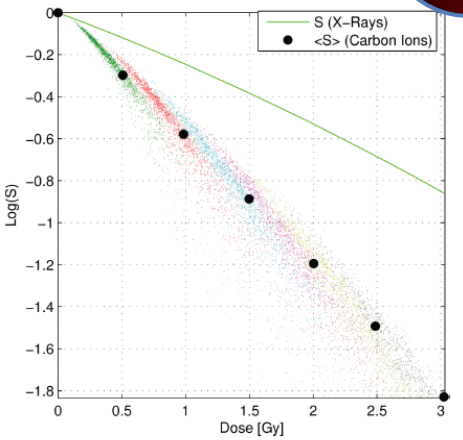




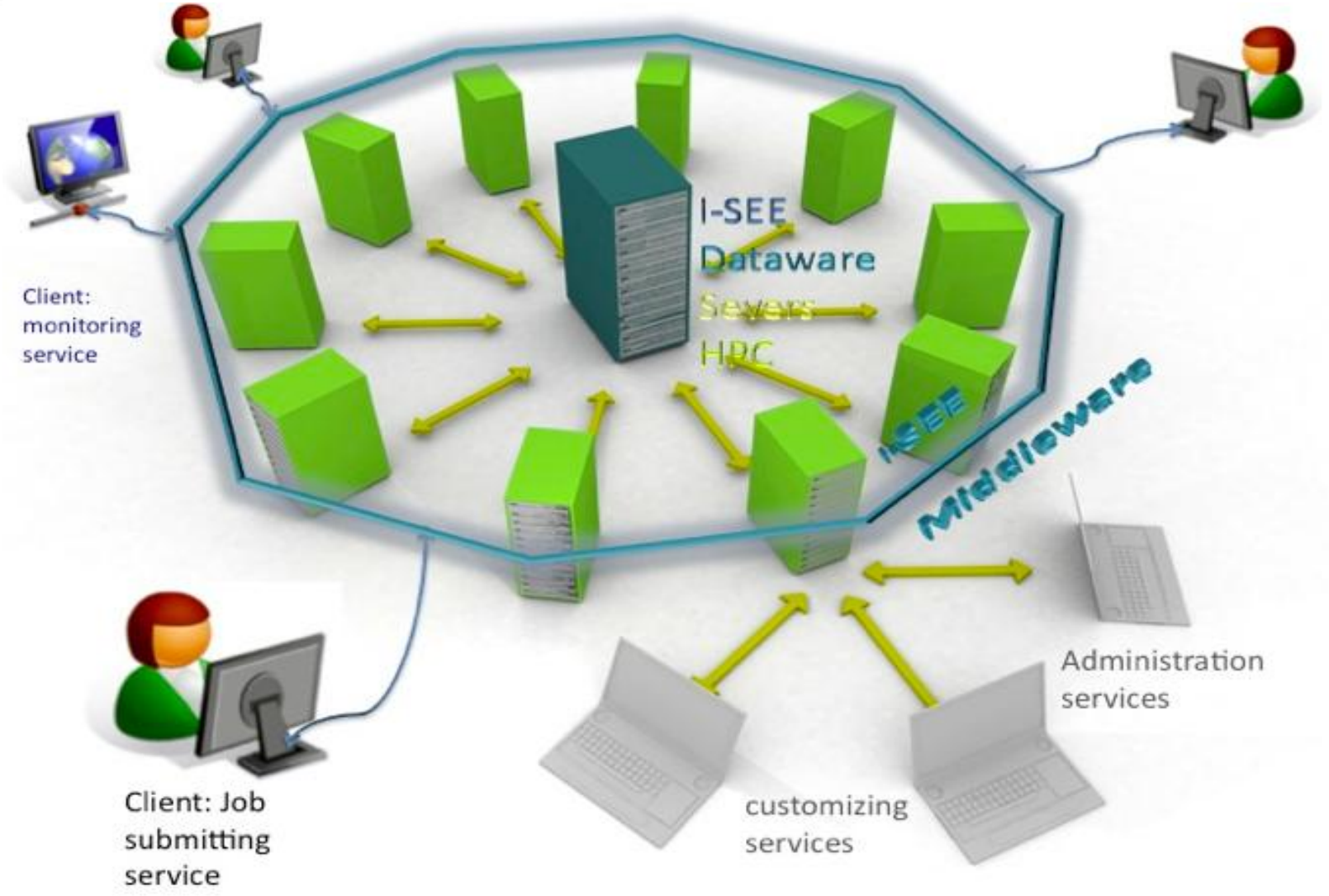
Dose Response Curves for Cell Survival



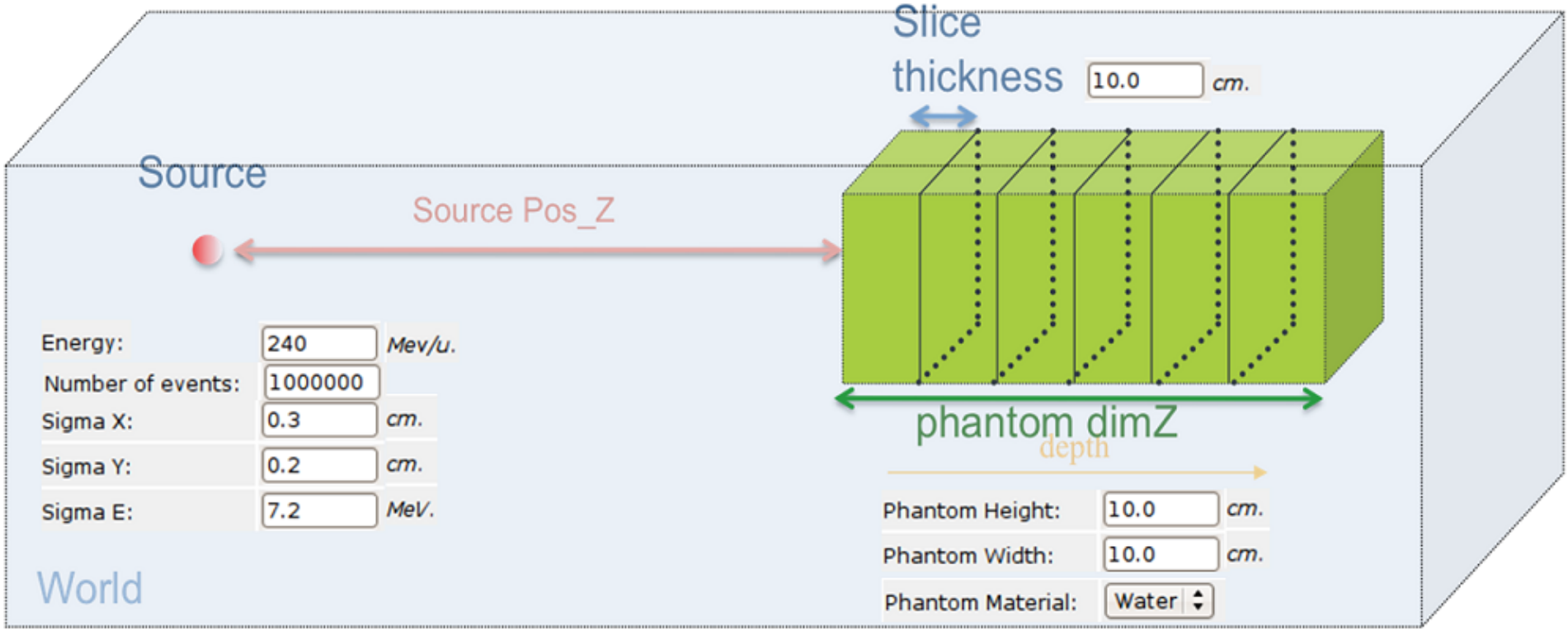
$$S_{Ion} = \langle S \rangle$$

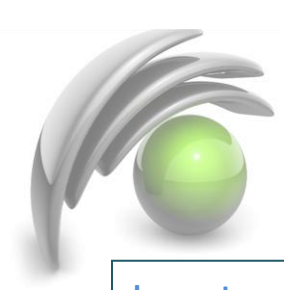


I-SEE Solution



I-SEE@Nucleonica Interface





Input:

- Simulation Name
- Run ID
- Particle type: P or C ions
- Beam Energy
-Source Pos_Z
-Source Pos_X
- Source Pos_Y
-Nummer of events(initial particles)
-Beam dimensions: Sigma in X and Y
- Sigma in Energy
- Phantom dimZ (depth)
- Phantom dimX
- Phantom dimY
- Slice thickness
- Phantom material
- Short description

I-SEE: Beam Simulations Submission page

Simulation Name:	Pencil_Beam_01	
Author:		
Main Parameters		
Particle Type:	C	*Select the primary particle type.*
Energy:	240	*Mev/u.*
Number of events:	1000000	*Number of primary events.*
Simulation Tool:	Geant4	*Select the simulation code.*
Secondary Parameters		
Sigma X:	0.3	*cm.*
Sigma Y:	0.2	*cm.*
Sigma E:	7.2	*MeV.*
Geometry and Materials		
Phantom Thickness:	10.0	*cm.*
Phantom Height:	10.0	*cm.*
Phantom Width:	10.0	*cm.*
Slice Thickness:	10.0	*cm.*
Phantom Material:	Water	*Specify the phantom material.*

Description:

Test for Pencil Beam.

Submit Scene

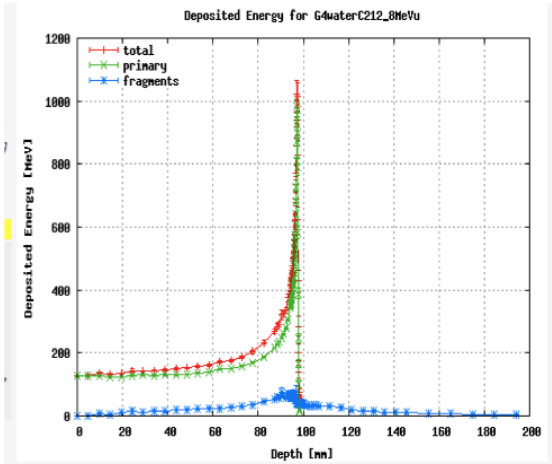
Output:

-Total Energy loss in depth

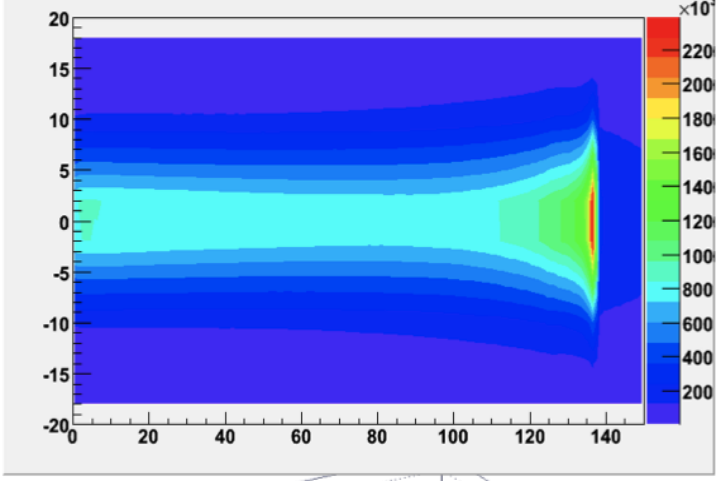
- Fragments Energy loss in depth

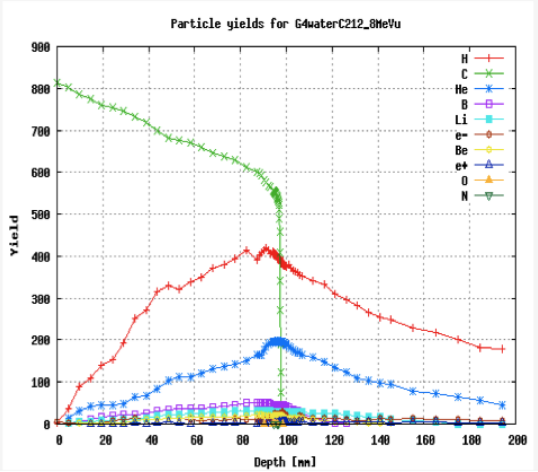
- 2d graphs

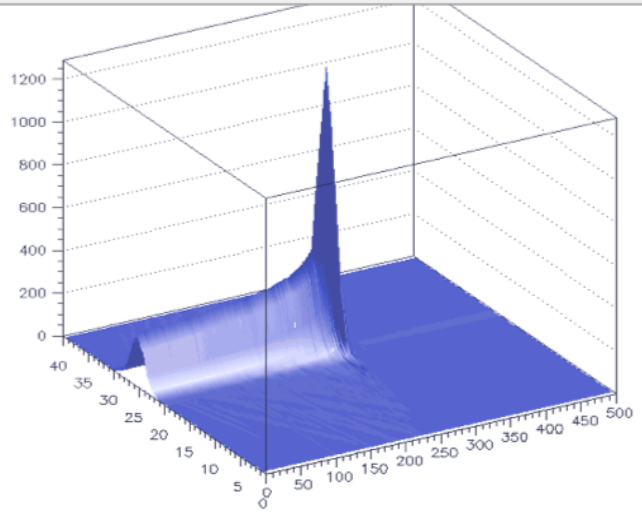
- 3d graphs



Download energy files: [total] | [primaries] | [fragments]





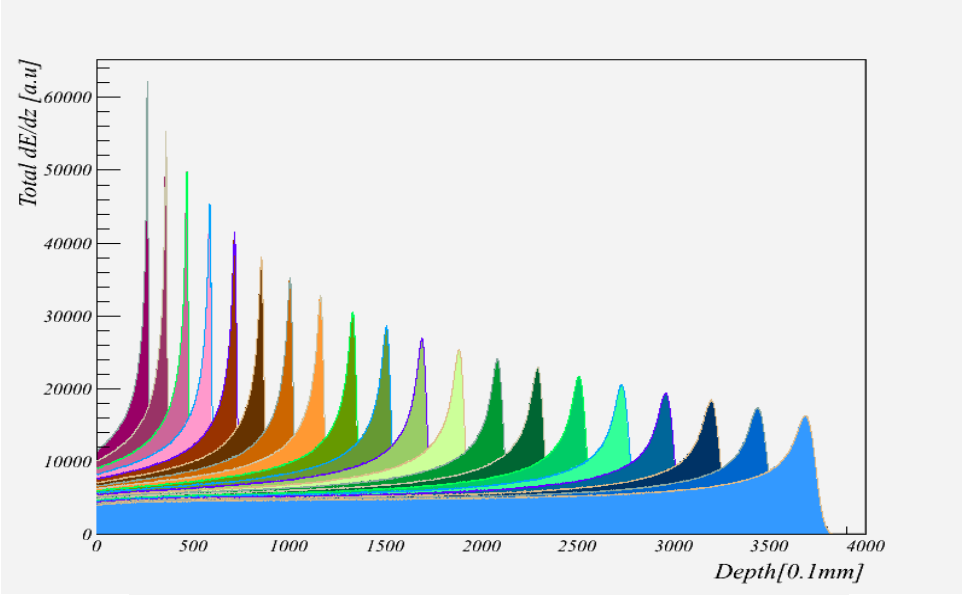


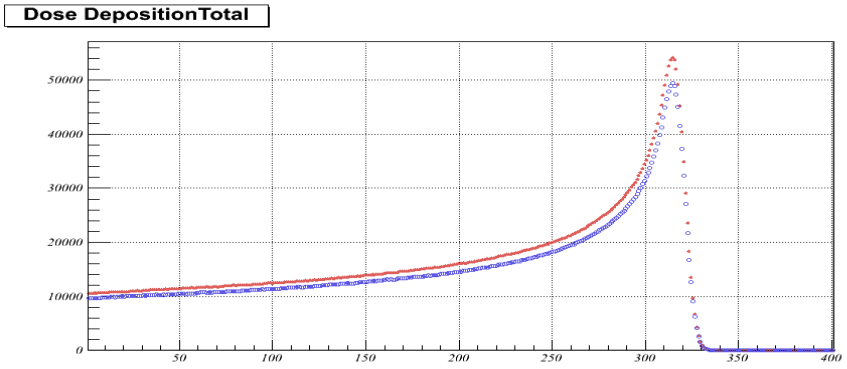
Note:

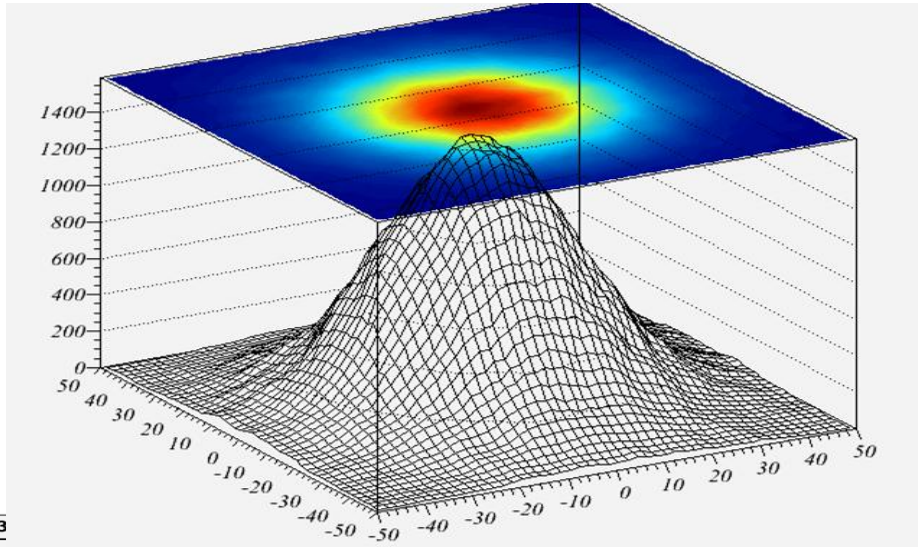
-It is possible to generate directly the graph in different graphic formats, otherwise we can export in Ascii format.

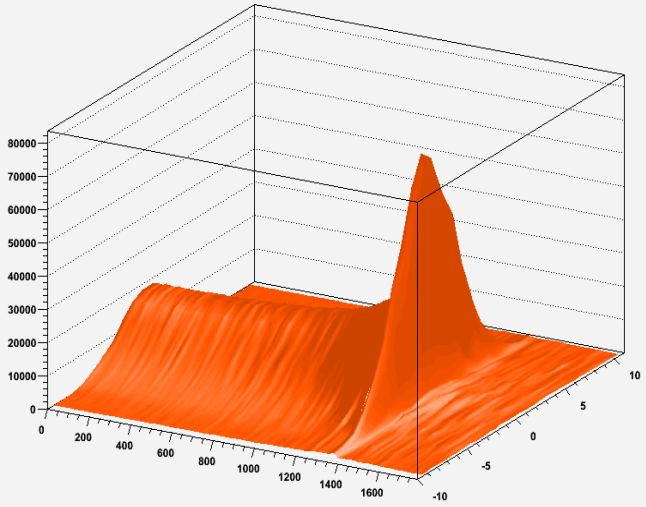
- 3d distribution can be as well automaticly generated and represented in graphs.

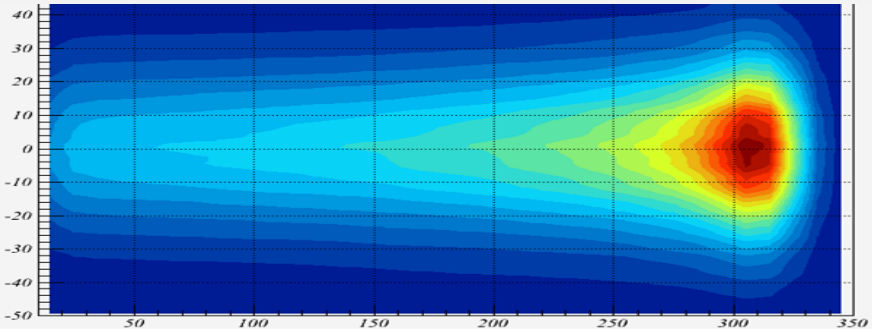
Analysis Examples



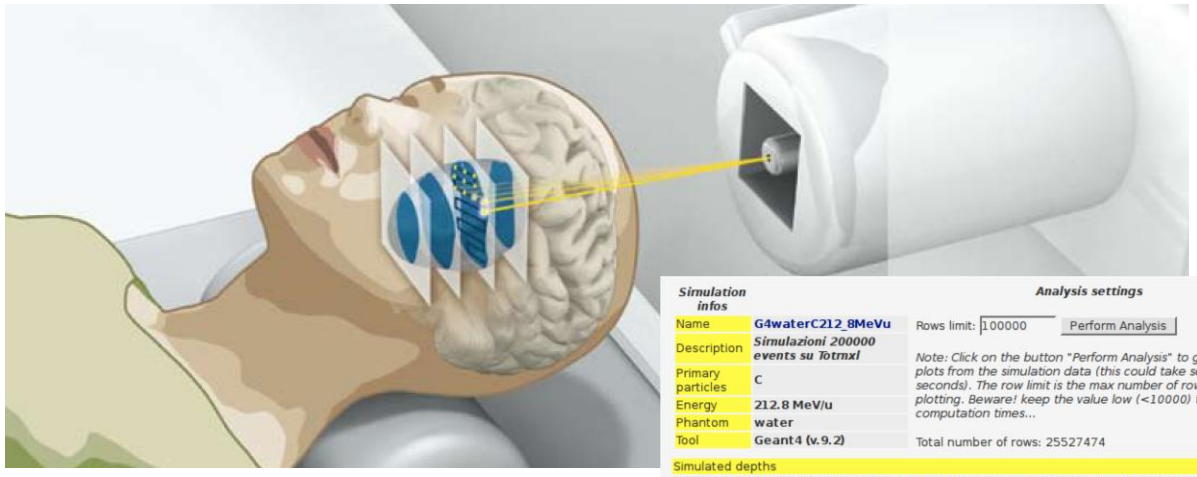








I-SEE CUSTEMIZED PRODUCTS



Simulation infos

Name	G4waterC212_8MeVu
Description	*Simulazioni 200000 events su Totmxl*
Primary particles	C
Energy	212.8 MeV/u
Phantom	water
Tool	Geant4 (v.9.2)

Analysis settings

Rows limit: 100000 Perform Analysis

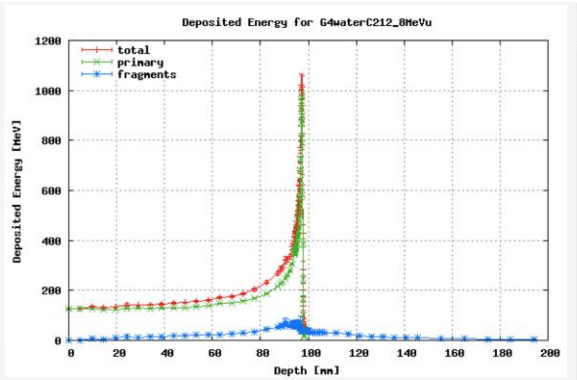
Note: Click on the button "Perform Analysis" to generate plots from the simulation data (this could take several seconds). The row limit is the max number of rows used for plotting. Beware! keep the value low (<10000) to avoid big computation times...

Total number of rows: 25527474

Simulated depths

0.005, 4.86, 9.714, 14.569, 19.423, 24.278, 29.133, 33.987, 38.842, 43.697, 48.551, 53.406, 58.26, 63.115, 67.97, 72.824, 77.679, 82.533, 87.388, 88.359, 89.33, 90.301, 91.272, 92.243, 93.214, 94.185, 94.282, 94.379, 94.476, 94.573, 94.67, 94.767, 94.864, 94.961, 95.058, 95.155, 95.253, 95.35, 95.447, 95.544, 95.641, 95.738, 95.835, 95.932, 96.029, 96.126, 96.223, 96.321, 96.418, 96.515, 96.612, 96.709, 96.806, 96.903, 97, 97.097, 97.194, 97.291, 97.389, 97.486, 97.583, 97.68, 97.777, 97.874, 97.971, 98.068, 98.165, 98.262, 98.359, 98.457, 98.554, 98.651, 98.748, 98.845, 98.942, 99.039, 99.136, 99.233, 99.33, 99.427, 99.525, 99.622, 99.719, 99.816, 99.913, 100.01, 100.981, 101.952, 102.923, 103.894, 104.865, 105.836, 106.806, 111.661, 116.516, 121.37, 126.225, 131.08, 135.934, 140.789, 145.643, 155.353, 165.062, 174.771, 184.48, 194.19

Note: Click on a depth to generate a plot of the particle energy distribution for the selected depth.



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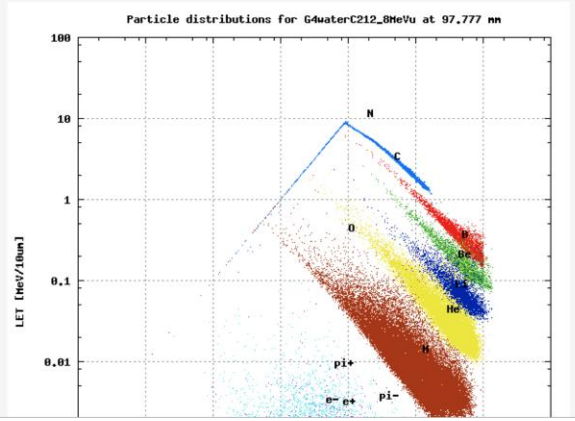
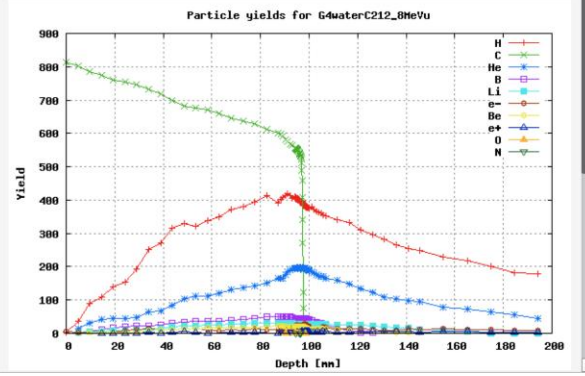
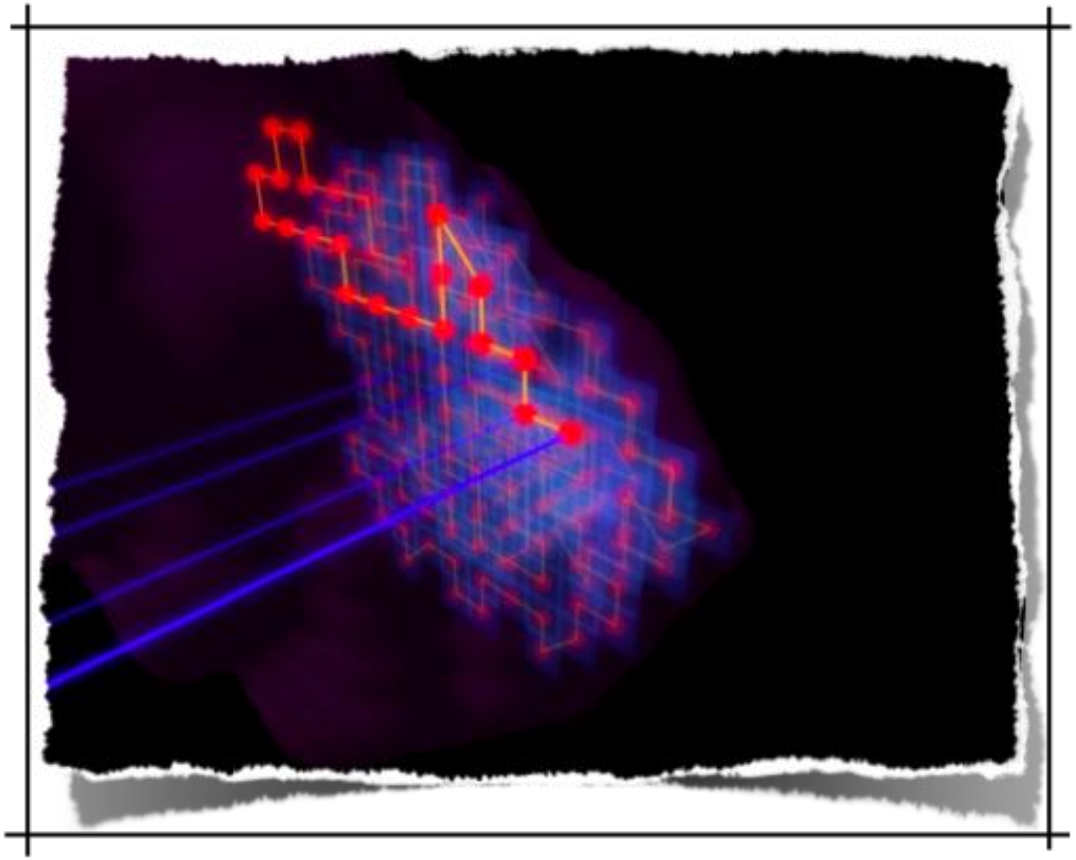
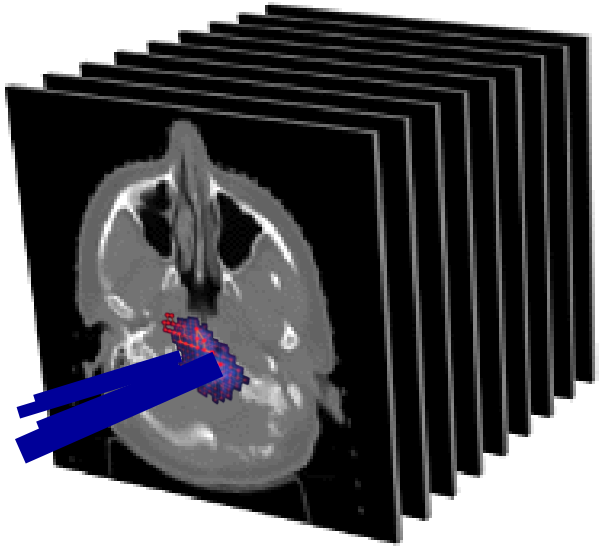




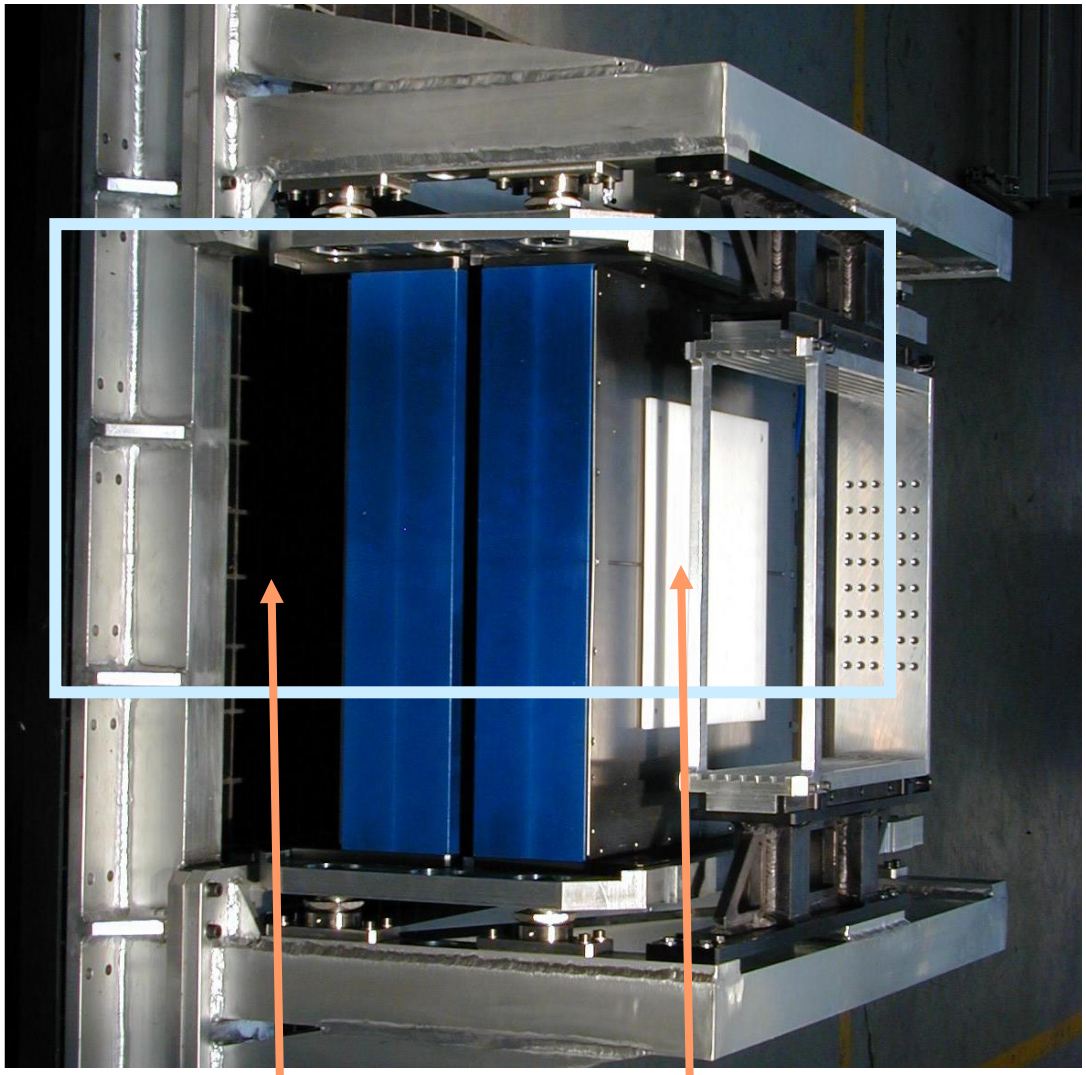
I-SEE CUSTEMIZED PRODUCTS



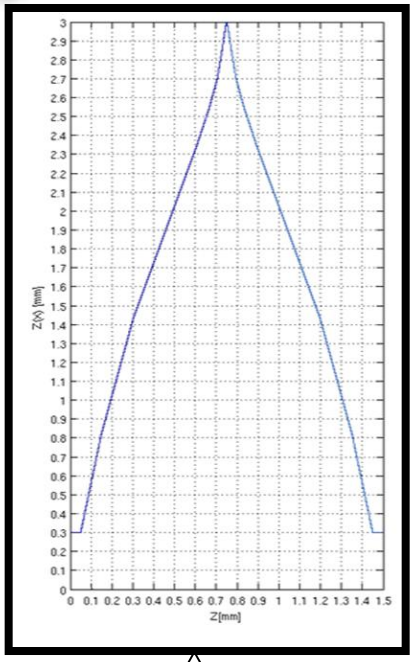


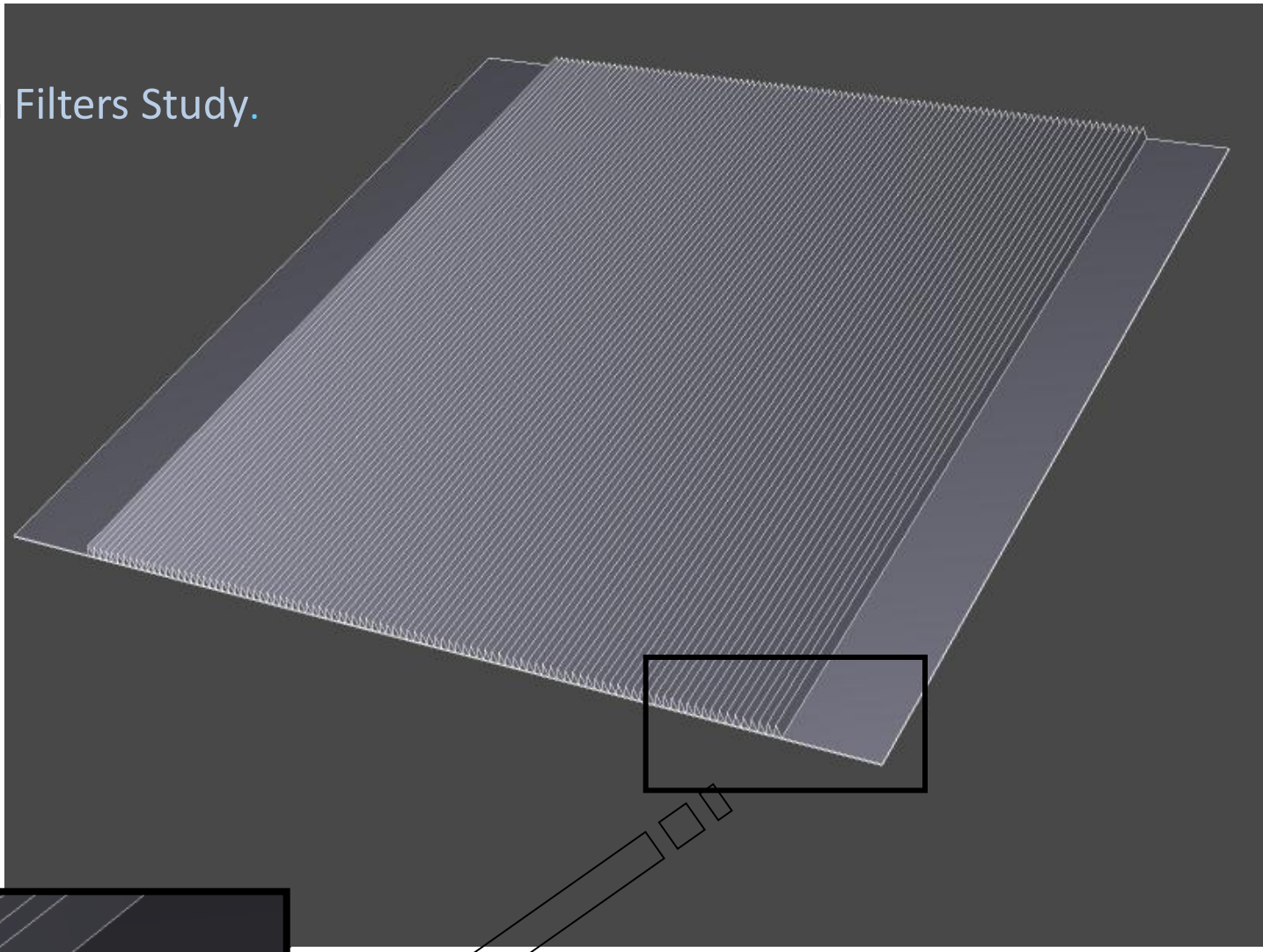
I-SEE CUSTEMIZED PRODUCTS

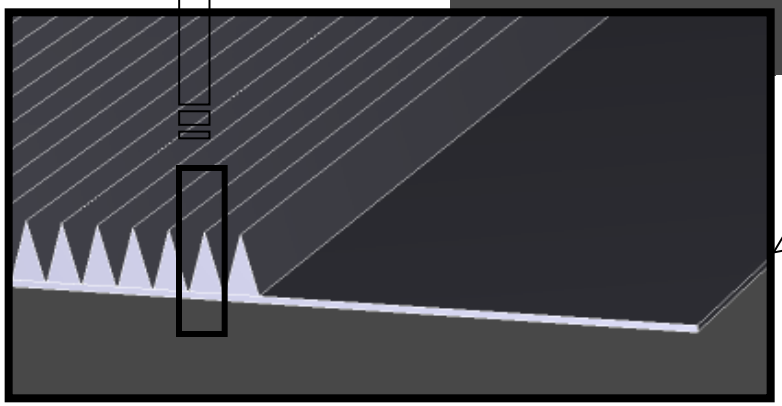
Monitoring system in the Beam Delivery line

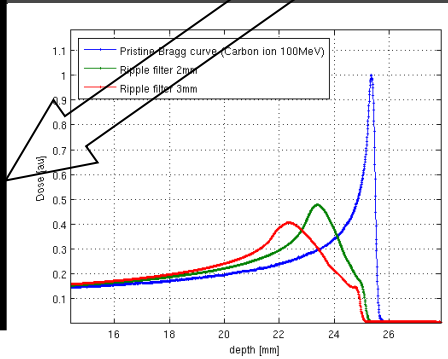


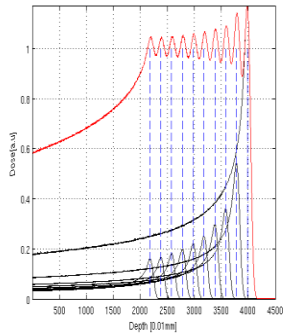
Beam Filters Study.

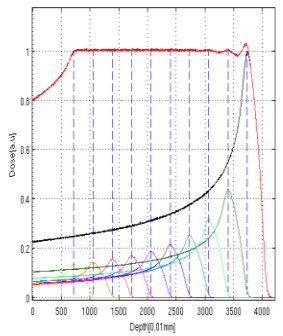




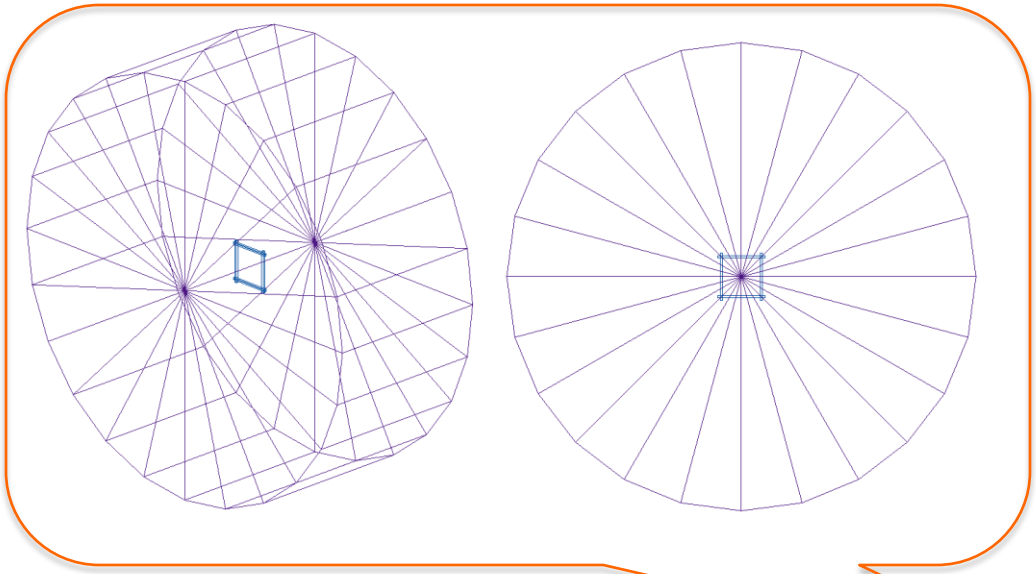


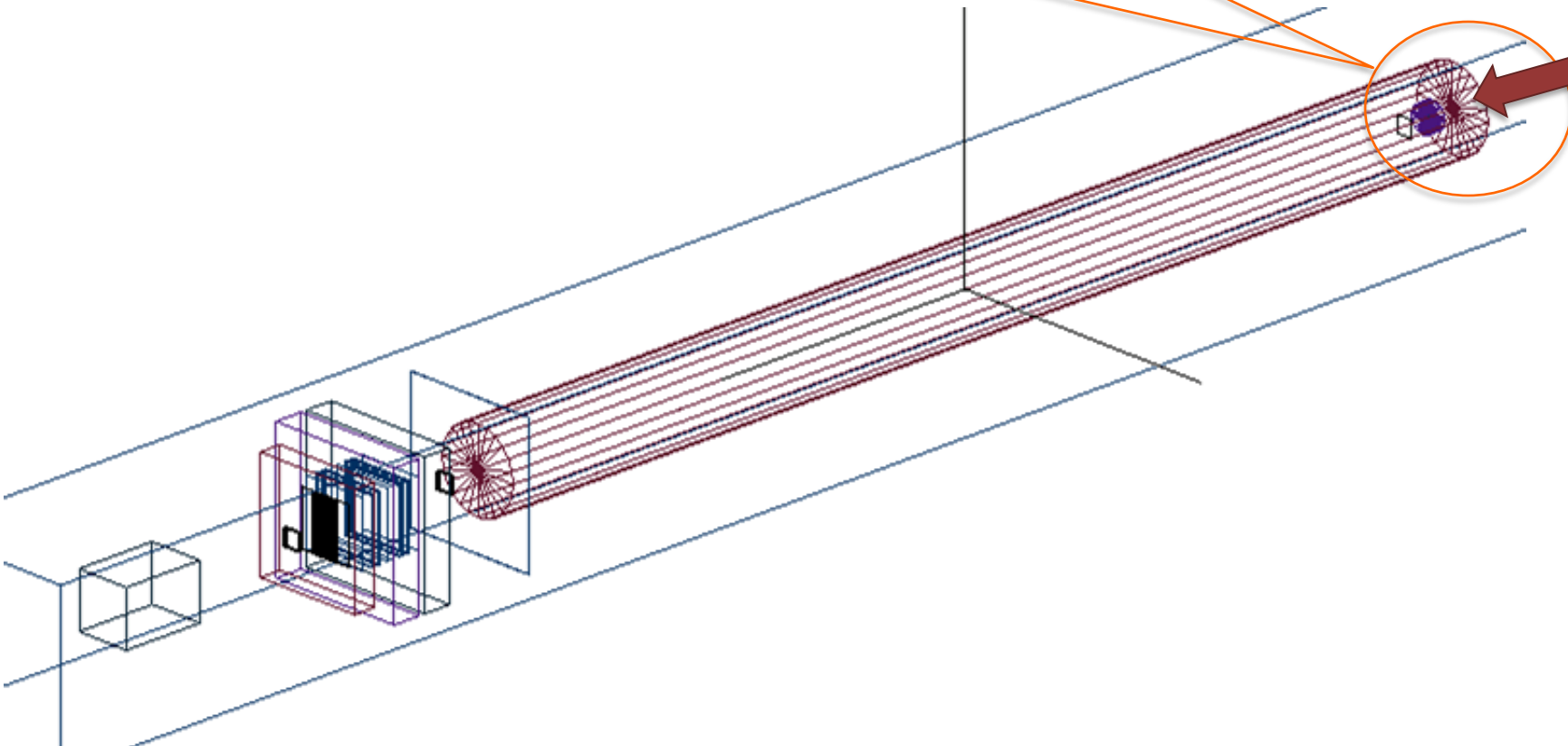




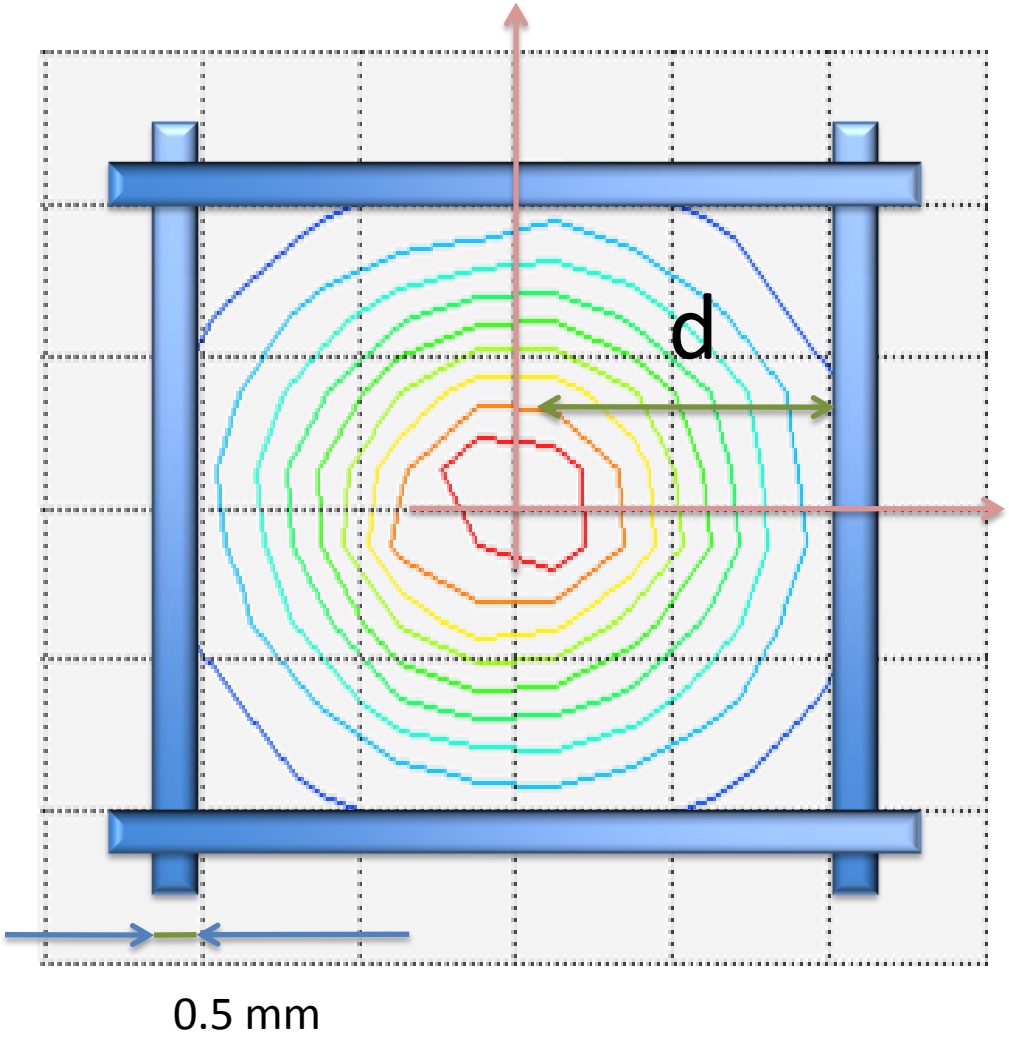


Beam Diagnostics

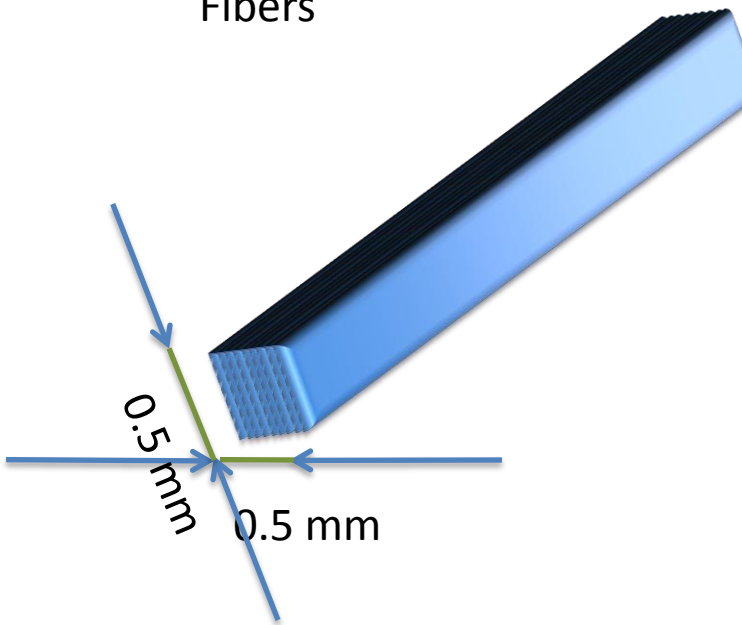




Watch Dog



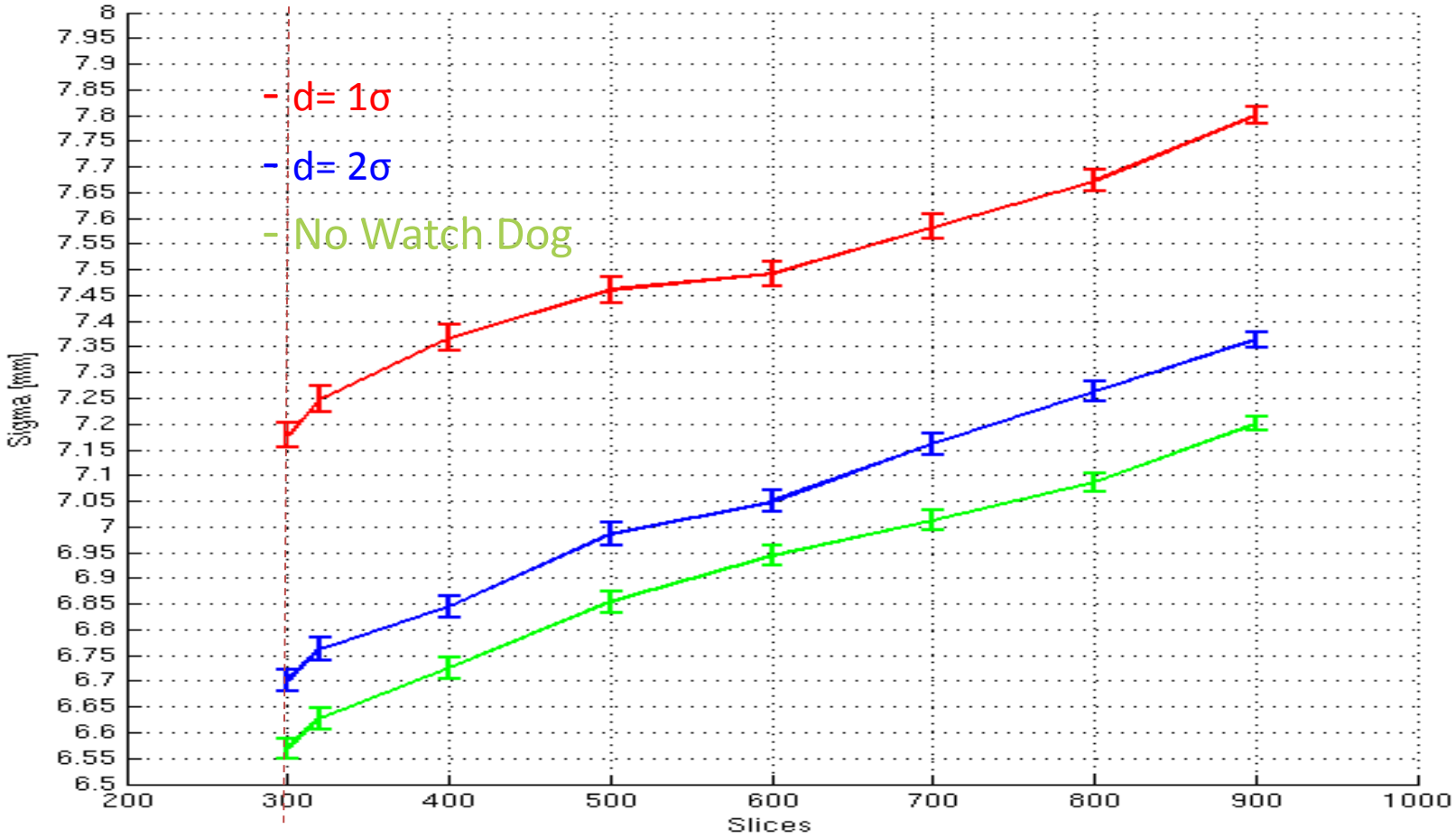
Fibers



Watch Dog

Scattering Effects

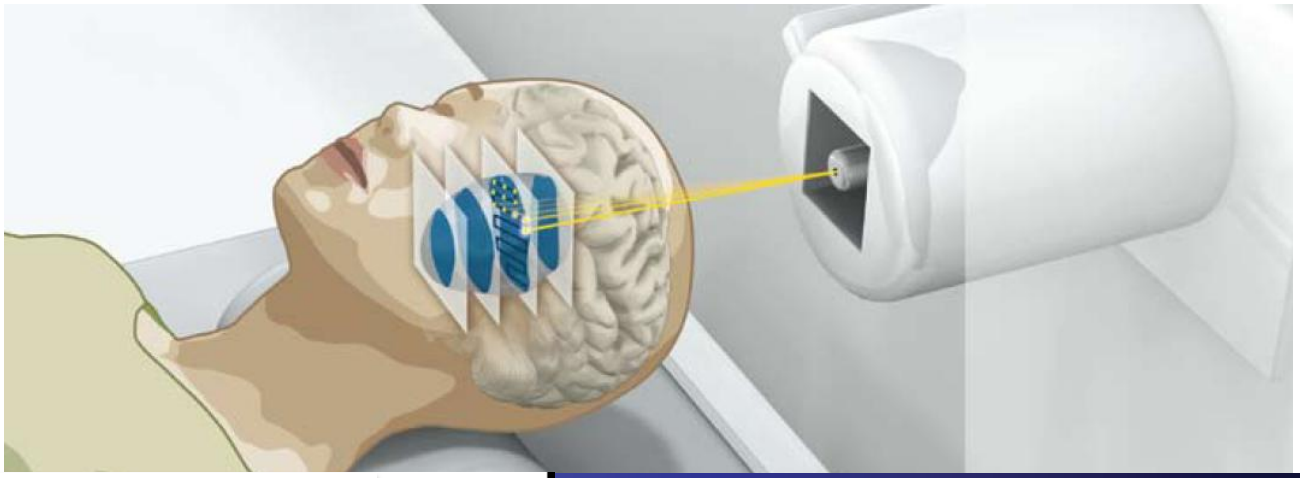
Sigma of the beam in X direction in the Water Phantom



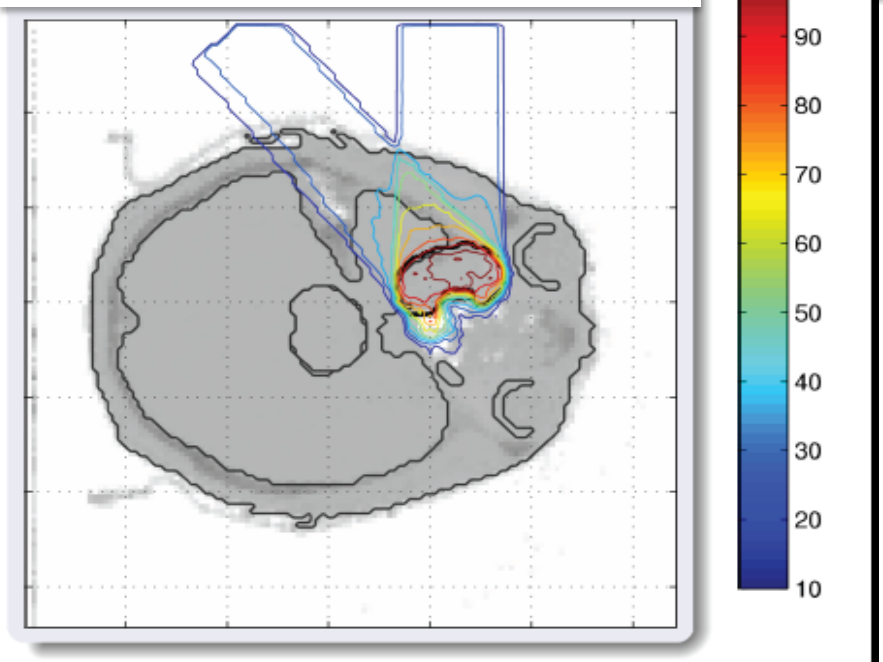
0

6cm

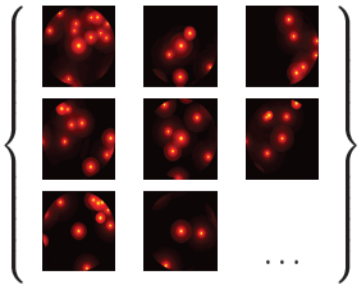
Planning Verification



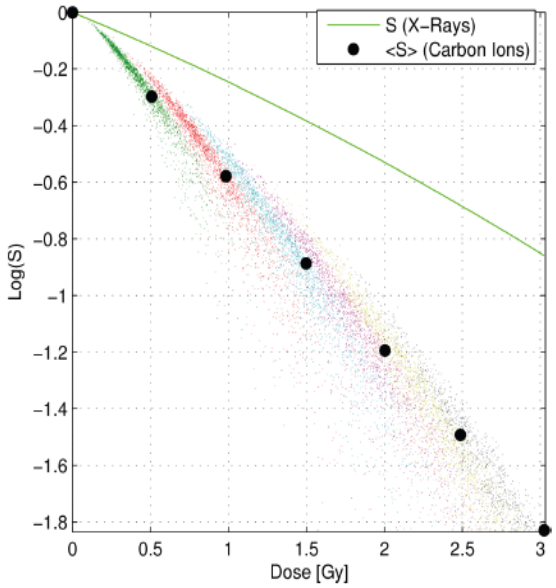
Carbon ion beam



Dose Response Curves for Cell Survival



$$S_{Ion} = \langle S \rangle$$



Open I-SEE

- Open for possible new solutions focused on online ‘heavy computing’.
- Open to new ideas
- Open to create and customize a new solutions
- Open to any questions ☺

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Tanks for your attention